BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PATENT SPECIFICATION

724,624

Date of Application and filing Complete Specification :
July 11, 1953. *No. 19296/53.*

Complete Specification Published : Feb. 23, 1955.

Index at Acceptance :—Class 97(1), L4B2.

COMPLETE SPECIFICATION.

Improvements relating to Stereoscopic Range Finders.

I, OTTO KURT KOLB, of British Optical & Precision Engineers Limited, 8 Shepherds Bush Road, Hammersmith, London, W.6, a British Subject, do hereby declare the invention, (a communication from abroad from HENDRIK DE LANG, Gorechtkade 103A, Groningen, Holland, of Dutch nationality,) for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to improvements in range finders utilising a method for finding the range of an object in which the object is observed directly with both eyes and hence stereoscopically and the invention is particularly, although not exclusively, useful in conjunction with photographic and television cameras.

The basic principle of stereoscopic range finding consists of the simultaneous binocular observation of an object and of the apparently superimposed virtual images of indicating marks carried by the range finding instrument and the object of the present invention is to provide apparatus utilising this principle in a simpler and more convenient manner than heretofore.

According to the invention, this apparatus consists of a body housing two semi-transparent concave mirrors having their optical axes parallel and fixed at approximately interpupillar distance, two separate indicating marks mounted for displacement in unison along—or substantially so—paths symmetrically disposed with respect to an axis positioned equidistantly between the optical axes of the mirrors and directed towards that axis and also towards the mirrors permitting both virtual images of the indicating marks to appear to superimpose on the object whose range is to be measured, and a scale associated with the indicating mark displacement means calibrated from the amount of displacement of said indicating marks to give the range.

The invention will now be described with reference to the accompanying drawing, in which :—

Fig. 1 illustrates the principle of the apparatus of the invention ;

Fig. 2 illustrates constructional details of a preferred form of stereoscopic range finder according to the invention ; and

Fig. 3 illustrates details of an alternative form of focusing adjustment.

Referring now to Fig. 1, an observer's left and right eyes are indicated at LE and RE respectively and can observe through concave semi-transparent mirrors L1 and L2 an object V, of which the range or distance has to be measured. The mirrors are mounted in a fixed position with respect to each other and such that their respective optical axes A—A and B—B are parallel and the distance between them equal to the normal interpupillar distance of approximately 63 mm., the line C—C representing an axis positioned equidistantly between the axes A—A and B—B and passing through the object V under observation.

The two mirrors conveniently consist of concave glass supports which are given semi-reflecting coatings 2, applied in known manner, the reflecting surfaces being towards the observer's eyes and having focal points at F1 and F2 located on their respective axes A—A and B—B.

If separate indicating marks are located at each of the focal points F1 and F2, each concave mirror will form a virtual image at infinity of the mark located at its focal point.

If, however, the marks at the focal points F1 and F2 are moved away from the observer and in unison along paths F1—V1 and F2—V2, shown in broken lines, and symmetrically disposed with respect to the axis C—C and directed towards that axis and also towards the mirrors, the images of the marks

[*Price* 2*s.* 8*d.*]

formed by the mirrors will merge into one and move towards the observer along the axis C—C and thus can be readily made to appear to superimpose on the object whose range is to be measured. In practice, the paths F1—V1 and F2—V2 can be approximated (as shown in full lines) by circles having their centres close to the outside edges of the mirrors and indicated on Fig. 1 as at the points P1 and P2.

As the coatings 2 on the mirror supports L1 and L2 are semi-transparent and conveniently do not cover the whole of their supports the observer can readily see the object V which is under observation with both eyes and by bringing the images of the marks not only into coincidence with each other but also with the object 4, the distance to the object V can be calculated by the amount of displacement of the actual marks and this can be indicated on a scale calibrated to give the range.

Fig. 2 illustrates constructional details of a preferred form of stereoscopic range finder according to the invention utilising the principle described above with reference to Fig. 1.

In Fig. 2 the body of the range finder is indicated at 1 and this body carries two identical semi-transparent concave mirrors L1 and L2. The two mirrors are rigidly mounted at a fixed distance between their parallel optical axes equal to the normal interpupillar distance of approximately 63 mm. The mirrors consist of concave glass supports having semi-transparent reflecting coatings 2 applied in known manner with the reflecting surfaces towards the observer's eyes. The coatings 2 conveniently cover only a limited area of each glass support and desirably rather more extensively towards the centre of the range finder in order adequately to cover the area through which the observer sees the object under observation whilst permitting the uncovered areas of the glass supports to give an unrestricted view of the general scene.

Indicating marks M1, M2 conveniently in the form of identical transparent arrowheads formed on otherwise opaque plates are initially located at each of the focal points F1 and F2 of the mirrors or, in practice, even closer to the observer.

The marks M1 and M2 are fixed on the legs of T-shaped levers 3 and 4, the said levers being pivotally and respectively mounted at points P1 and P2 on the range finder such that movement of the levers 3 and 4 towards and away from the mirrors causes the marks M1 and M2 to be displaced in unison along paths substantially identical with those shown in full lines at F1—V1 and F2—V2 in Fig. 1.

The levers 3 and 4 are loaded by springs 5 and 6 respectively so that a flat end 7 on the lever 3 is urged against a fulcrum point 8 on the lever 4 and so that a flat end 9 of the lever 4 is urged against the tip of an adjusting screw 10, the adjusting screw 10 having a control knob 11 carrying a scale 12 calibrated in accordance with the amount of displacement of the marks M1 and M2 to give the distance of the object under measurement when read in conjunction with an index point 16.

In the operation of the range finder the observer looks with the left eye LE through an eye piece 13 and with the right eye RE through an eye piece 14 and, when the two marks M1 and M2 are both at the respective focal points F1 and F2, the observer will see at infinity two virtual images of the marks M1 and M2, these images being formed by the mirrors. Upon rotation of the control knob 11 the two levers 3 and 4 will be moved towards the mirrors and the marks M1 and M2 will consequently be displaced along paths substantially corresponding to F1—V1 and F2—V2 in full lines in Fig. 1 so that the two images of the marks M1 and M2, of which the left eye LE observes the image of M1 and the right eye RE the image of M2, will appear to coincide into a single virtual image. Due to the transparency of the glass mirror supports and the semi-transparency of the coatings 2, thereon, the observer will also be able to see the object whose distance has to be measured and by suitable rotation of the control knob 11 can adjust the marks M1 and M2 until their merged images appear to superimpose on the said object, the scale 12 on the control knob 11 being suitably calibrated to give the range of the object under observation.

The construction shown in Fig. 2 is such that the instrument does not need to be adjusted to the different interpupillar distances of between, approximately, 53 mm. to 73 mm. of different observers.

It will be appreciated that variations in the construction of the range finder may be made within the scope of the invention. For example, and as illustrated by Fig. 3, the adjusting screw 10 may be replaced by a cam 15 for moving the levers 3 and 4 upon rotation of the control knob 11 and it will be readily appreciated that the controls can be coupled to the focusing means of a taking lens in a photographic or television camera in which latter connexion the stereoscopic range finder will be most advantageous in keeping a moving object in constant focus by the simple operation of its controls.

What I claim is :—

1. A range finder for finding the range of an object in which the object is observed directly with both eyes, consisting of a body housing two semi-transparent concave mirrors having their optical axes parallel and fixed at approximately interpupillar dis-

tance, two separate indicating marks mounted for displacement in unison along—or substantially along—paths symmetrically disposed with respect to an axis positioned equidistantly between the optical axes of the mirrors and directed towards that axis and also towards the mirrors permitting both virtual images of the indicating marks to appear to superimpose on the object whose range is to be measured, and a scale associated with the indicating mark displacement means calibrated from the amount of displacement of said indicating marks to give the range.

2. A stereoscopic range finder as claimed in Claim 1, in which the indicating marks are mounted on levers pivoted at one end.

3. A stereoscopic range finder as claimed in Claim 2, in which the levers are spring loaded and their free ends urged into contact with each other and with adjusting means actuated by a control knob.

4. A stereoscopic range finder as claimed in Claim 3, in which the adjusting means comprise a screw connected to the control knob.

5. A stereoscopic range finder as claimed in Claim 3, in which the adjusting means comprise a cam integral with the control knob.

6. A stereoscopic range finder as claimed in any of Claims 3, 4 or 5, in which the said control knob carries a scale calibrated to give the range.

7. A stereoscopic range finder as claimed in any of the preceding claims, in which the mirrors consist of identical concave glass supports having a semi-transparent reflecting coating covering only a limited area of each support.

8. A stereoscopic range finder as claimed in any of the preceding claims, in which the indicating marks are identical transparent arrowheads formed on otherwise opaque plates.

9. A stereoscopic range finder as claimed in any of the preceding claims, when coupled to the focusing means of a photographic or television camera.

10. A stereoscopic range finder substantially as hereinbefore described with reference to, and as shown in, Fig. 2 of the accompanying drawing.

O. K. KOLB.

Abingdon : Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1955.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

724,624 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

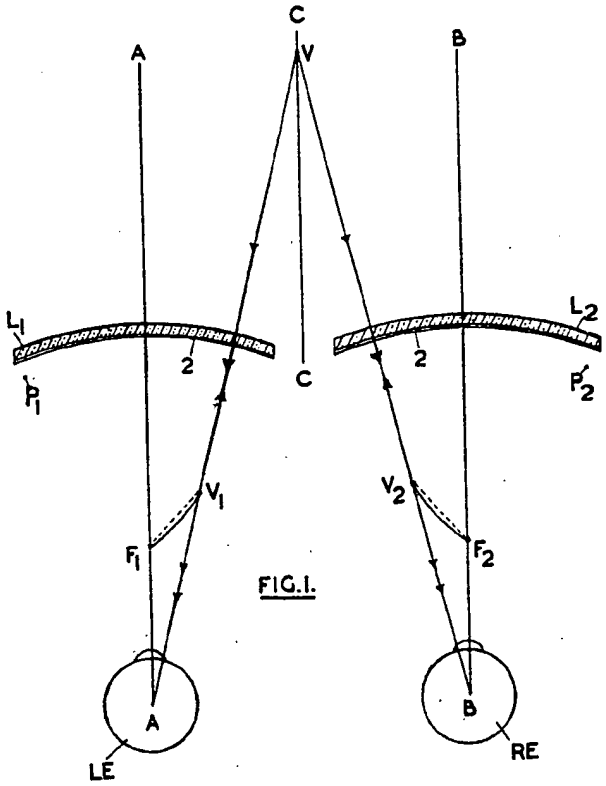

FIG.1.

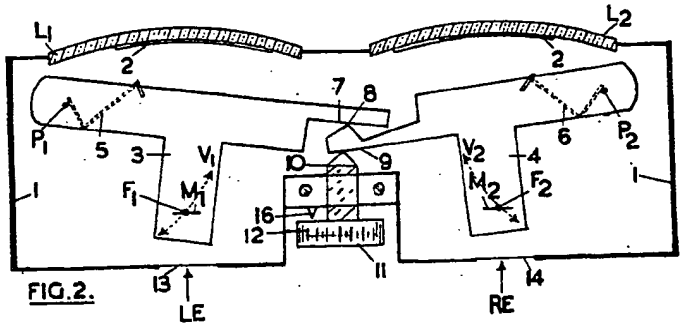

FIG.2.

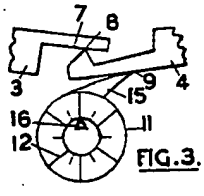

FIG.3.